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Title: *Wave-driven turbulence and kinetic dissipation in the Solar Corona*

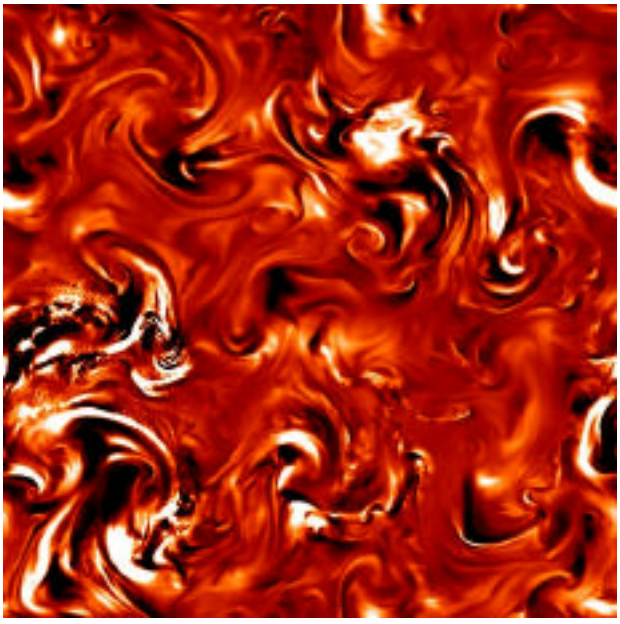
Cluster: *Cross-Theme Theory and Data Analysis/SECTP*

Contributor: *William Matthaeus/Bartol Group -University of Delaware*

- **Turbulent Reconnection — the Source of Lower Coronal Heating?**

Spartan sounding rockets and SOHO measurements have revealed that protons in the open field-line, coronal hole regions are heated to over 2,000,000˚K within one solar radius above the photosphere. Various signatures, such as high perpendicular temperatures and very hot minor ions, suggest how the kinetic plasma processes implement this heating. Until recently, the main candidate for producing these signatures was direct ion-cyclotron absorption of high frequency waves, with periods as small as 1/1000 seconds. However, it may be difficult to produce such waves in the photosphere, using its characteristic 100-1000 second motions. It is also difficult for nonlinear processes to produce such waves because MHD wave-cascade to low frequencies tends to produce fine spatial structure *across* the magnetic field, not along it as required for cyclotron heating. A recent model by the U. Delaware, SEC Theory Group has now shown that counter-streaming low frequency waves reflected from plasma density inhomogeneities could produce fine-scale current sheets and electric fields in randomly distributed reconnection sites and explain the coronal hole characteristics.

The responses of the coronal plasma to these electric field structures have useful terrestrial analogies. In the terrestrial aurora similar magnetic field-aligned electric fields drive proton beams or produce nonlinear electron solitary structures with their associated broadband electric-field noise. Hence, auroral region measurements, with a resolution better than currently available for the solar corona, can be used to enhance our understanding of coronal processes. The theoretical modeling provides a framework for directing future NASA experimental studies to unravel an important element of the Sun-to-Earth connection.



Simulation of the vertical electric field produced by wave- driven coronal turbulence (black/white indicates most intense downward/upward fields)

Local regions of intense parallel electric fields are produced. Based upon observational evidence from WIND and spacecraft in the terrestrial aurora, it is inferred that heating in coronal holes is due to proton beam-driven instabilities or noisy nonlinear electron kinetic processes.

References: Coronal Heating distribution due to low frequency wave driven turbulence, P. Dmitruk, W. Matthaeus, L. Milano, S. Oughton, G. Zank and D. Mullan, Astrophys. J., in press (2002) ; MHD turbulence and heating of the open field line corona, W. Matthaeus, D. Mullan, P. Dmitruk, L. Milano and S. Oughton, **Nonlinear Proc. in Geophys,** in press , 2002.